

Complete Summary

GUIDELINE TITLE

Diagnostic imaging practice guidelines for musculoskeletal complaints in adults - an evidence-based approach. Part 1: lower extremity disorders.

BIBLIOGRAPHIC SOURCE(S)

Bussieres AE, Taylor JA, Peterson C. Diagnostic imaging practice guidelines for musculoskeletal complaints in adults--an evidence-based approach. Part 1. Lower extremity disorders. J Manipulative Physiol Ther 2007 Nov-Dec;30(9):684-717. [212 references] [PubMed](#)

GUIDELINE STATUS

This is the current release of the guideline.

The literature review and the guidelines should be updated every 3 years.

COMPLETE SUMMARY CONTENT

SCOPE
METHODOLOGY - including Rating Scheme and Cost Analysis
RECOMMENDATIONS
EVIDENCE SUPPORTING THE RECOMMENDATIONS
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS
QUALIFYING STATEMENTS
IMPLEMENTATION OF THE GUIDELINE
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT
CATEGORIES
IDENTIFYING INFORMATION AND AVAILABILITY
DISCLAIMER

SCOPE

DISEASE/CONDITION(S)

Musculoskeletal disorders of the lower extremities

GUIDELINE CATEGORY

Diagnosis
Evaluation
Risk Assessment

CLINICAL SPECIALTY

Chiropractic
Emergency Medicine
Family Practice
Geriatrics
Orthopedic Surgery
Physical Medicine and Rehabilitation
Radiology
Sports Medicine

INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Chiropractors
Health Care Providers
Health Plans
Hospitals
Nurses
Physical Therapists
Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

- To develop evidence-based diagnostic imaging practice guidelines to assist chiropractors and other primary care providers in decision making for the appropriate use of diagnostic imaging of lower extremity disorders
- To reduce unnecessary radiation exposure and the use of specialized imaging studies, increase examination precision, and decrease health care costs—all without compromising quality of care

TARGET POPULATION

Adult patients presenting with musculoskeletal disorders of the lower extremities

Note: Children and pregnant patients are excluded from these guideline recommendations.

INTERVENTIONS AND PRACTICES CONSIDERED

Diagnostic Assessment

1. Computed tomography (CT)
2. Magnetic resonance arthrography (MRA)
3. Magnetic resonance imaging (MRI)
4. Nuclear medicine (bone scan) (NM)
5. Ottawa ankle and foot rules (OAR)
6. Ottawa knee rules (OKR)
7. Range of motion (ROM)
8. Ultrasound (US)
9. Plain film radiograph

MAJOR OUTCOMES CONSIDERED

- Accuracy of diagnostic tests
- Utility of radiologic examinations in differential diagnosis
- Swelling and pain
- Speed of return to normal activity level
- Reinjury rates

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Secondary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Electronic searches in English and French language literature occurred, and cross-references were repeated on 3 different occasions between 2003 and 2006.

A comprehensive search of the English and French language literature was conducted using a combination of subject headings and keywords.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Levels of Evidence

Classification based on Stroke Prevention and Educational Awareness Diffusion (SPREAD) validated methodological criteria.

1++: High-quality meta-analyses without heterogeneity, systematic reviews of randomized controlled trials (RCTs) each with small confidence intervals CI), or RCTs with very small CI and/or very small alpha and beta

1+: Well-conducted meta-analyses without clinically relevant heterogeneity, systematic reviews of RCTs, or RCTs with small CI and/or small alpha and beta

1-: Meta-analyses with clinically relevant heterogeneity, systematic reviews of RCTs with large CI, or RCTs with large CI and/or alpha or beta

2++: High-quality systematic reviews of case-control or cohort studies. High-quality case-control or cohort studies with very small CI and/or very small alpha and beta

2+: Well-conducted case-control or cohort studies with small CI and/or small alpha and beta

2-: Case-control or cohort studies with large CI and/or large alpha or beta

3: Nonanalytic studies, (e.g., case reports, case series)

4: Expert opinion

– (minus): Meta-analyses with clinically relevant heterogeneity; systematic reviews of trials with large confidence intervals; trials with large CIs, and/or large alpha and/or beta

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Methods for Synthesizing Evidence

1. Literature search and independent literature assessment of spinal disorders: Quality of Diagnostic Accuracy Studies (QUADAS), Appraisal of Guidelines Research and Evaluation (AGREE), and Stroke Prevention and Educational Awareness Diffusion (SPREAD).
2. Initial draft. Template based on European Commission classification (2001).
3. Expert consensus. A 2-round modified Delphi process was used to generate consensus among an international panel of more than 60 experts in musculoskeletal disorders.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

A Delphi panel composed of international experts on the topic of musculoskeletal disorders in chiropractic radiology, clinical sciences, and research were invited to review and propose recommendations on the indications for diagnostic imaging.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Grades of Recommendation

The Stroke Prevention and Educational Awareness Diffusion (SPREAD) tool has been developed to grade recommendations according to the strength of available scientific evidence (level A to D)

A: At least one meta-analysis, systematic review or RCT rated as 1++, and directly applicable to the target population; or a systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results

B: A body of evidence including studies rated as 2++, directly applicable to the target population and demonstrating overall consistency of results; or extrapolated evidence from studies rated as 1++ or 1+

C: A body of evidence including studies rated as 2+, directly applicable to the target population And demonstrating overall consistency of results; or extrapolated evidence from studies rated as 2+**

D: Evidence level 3 or 4; or extrapolated evidence from studies rated as 2+; or evidences from trials classified as (minus) regardless of the level

Good practice point: Recommended best practice based on the clinical experience of the guideline development group, without research evidence.

This tool aims to evaluate the scientific evidence according to prespecified levels of certainty (1++ to 4). In this study, Good Practice Point also represents consensus of the Delphi panel. CI indicates confidence intervals.

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Clinical Validation-Pilot Testing
Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The guidelines were pilot tested and peer reviewed by field chiropractors, and by chiropractic and medical specialists.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

The grades of recommendations (A-D and GPP) and levels of evidence (1++, 1+, 1-, 2++, 2+, 2-, 3, 4) are defined at the end of the "Major Recommendations" field.

Table 1: Adult Hip Disorders

Patient Presentation	Recommendations
<p>Adult patients with full or limited movement and nontraumatic hip pain of <4 weeks of duration</p> <p>Symptoms are often transient. Physical examination is primarily to discriminate between articular involvement and referred pain. Each age and sex exhibit typical specific hip, pelvis, and proximal thigh problems and diseases.</p>	<p>Radiographs not initially indicated [C]</p>
<p>General indications for radiographs include:</p> <ul style="list-style-type: none"> • Failed conservative treatment • Complex history • History of noninvestigated trauma • Significant unexplained hip pain with no previous films • Loss of mobility in undiagnosed condition • Acute or subacute onset of intermittent locking • Palpable enlarging mass 	<p>If radiographs are indicated [B]</p> <p>Anteroposterior (AP) pelvis and AP frog leg views</p> <p>Special investigations [C]</p> <p>Magnetic resonance imaging (MRI), is the procedure of choice to exclude osteonecrosis, marrow and joint disease including infection</p>
<p>Specific clinical diagnoses</p>	<p><i>Consult specific clinical diagnoses and related patient presentations for additional help in decision making.</i></p>
<p>1. Strain, tendinitis or tendinosis</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Pain aggravated by activity, resistance testing, and with length-tension evaluation (muscle stretch). • "Snapping hip" usually results from iliopsoas tendinitis (internal) or iliotibial band (external) involving both the bursa and tendon. • Suspect adductor muscle strains with medial or anterior thigh pain aggravated by passive abduction 	<p>Radiographs indicated in suspected osseous avulsion fracture [D]</p> <p>AP pelvis and AP frog leg views</p> <p>Special investigations [D]</p> <ul style="list-style-type: none"> • MRI for soft tissue involvement (edema, hemorrhage, frank disruption) and bony abnormality. • Ultrasound (US) may demonstrate site and amount of tissue disruption.

Patient Presentation	Recommendations
or resisted adduction.	
<p>2. Piriformis syndrome</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Dull posterior hip pain radiating down the leg • May mimic discogenic radicular pain and facet joint referred pain • Limping • Pain aggravated by active external rotation, passive internal rotation, or palpation of sciatic notch 	<p>Radiographs not initially indicated [D]</p> <p>Special investigations [D]</p> <ul style="list-style-type: none"> • MRI if unresponsive to care to assess muscle asymmetry and sciatic nerve hyperintensity at the sciatic notch • MRI or US may reveal bursitis
<p>3. Nontraumatic trochanteric and iliopsoas bursitis</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Localized tenderness and pain • Moderate perceived weakness on resistive testing and length-tension evaluation (whereas true weakness may suggest abnormality such as avulsion of underlying muscle) 	<p>Radiographs not initially indicated [D]</p> <p>Special investigations [D]</p> <ul style="list-style-type: none"> • MRI useful in chronic or recurrent bursitis and is most accurate for iliopsoas bursitis • US is a cost-effective, easy-to-perform, and fast alternative. However, it fails to demonstrate iliopsoas bursitis in about 40% of cases.
<p>4. Osteoporotic femoral neck fractures</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Patients typically aged >65 years • Often after a fall • Unable to walk • May exhibit shortening and external rotation of the affected limb and localized hip pain <p>Occasionally:</p> <ul style="list-style-type: none"> • Able to walk • Nonspecific leg discomfort 	<p>Radiographs indicated [C]</p> <p>AP spot and AP pelvis view</p> <p>Special investigations [D]</p> <p>If radiographs negative but clinically suspected, consider MRI, computed tomography (CT), or nuclear medicine (NM).</p> <ul style="list-style-type: none"> • Dual-energy x-ray absorptiometry recommended

Patient Presentation	Recommendations
<ul style="list-style-type: none"> No obvious shortening or malrotation deformity 	
<p>5. Septic arthritis of the hip</p> <p>Clinical features:</p> <ul style="list-style-type: none"> Significant pain on movement and weight bearing Malaise Fever 	<p>Radiographs indicated [C]</p> <p>AP spot and AP frog leg views</p> <p>Special investigations [D]</p> <ul style="list-style-type: none"> MRI is the imaging modality of choice for infection. Joint aspiration or surgery NM very sensitive but not specific for suspected septic arthritis and osteomyelitis
<p>Consider obtaining radiographs in adult patients with chronic hip pain unresponsive to 4 weeks of conservative care or if one of the following conditions is suspected:</p> <ol style="list-style-type: none"> Congenital or developmental abnormalities Osteoarthritis (OA) (limited range of motion [ROM]) Inflammatory arthritis Osteonecrosis Tumors Stress fractures or undisplaced fractures 	<p>Radiographs indicated [D]</p> <p>AP spot and AP frog leg</p> <p>Additional views: AP pelvis in suspicion of congenital abnormality, osteonecrosis, inflammatory arthritis</p> <p>Special investigations [D]</p> <ul style="list-style-type: none"> Unenhanced MRI done first (highly sensitive) Magnetic resonance (MR) arthrography Anesthesia injection Examination under local anesthesia Diagnostic arthroscopy
Specific Clinical Diagnoses	
<p>1. Congenital/developmental abnormalities</p> <p>Plain film radiograph as primary investigation for chronic hip pain, "knife sharp" groin pain, painful giving way, locking and painful clunk, and painful apprehension and impingement tests includes:</p>	<p>Radiographs indicated [D]</p> <p>Standing AP pelvis and recumbent AP false profile view</p> <p>Additional views: Abduction view of the hip (to determine eligibility for joint preserving surgery)</p>

Patient Presentation	Recommendations
<p>a. Acetabular dysplasia Exclude in athlete aged <30 years with chronic hip pain.</p> <p>b. Labral tear and femoroacetabular impingement</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • "Knife sharp" groin pain • Painful giving way syndrome • Locking • Painful clunk or snapping hip • Painful apprehension tests (forced hyperextension-external rotation in slight abduction) • Painful impingement test (forced flexion adduction) 	<p>Special investigations [D]</p> <ul style="list-style-type: none"> • Unenhanced MRI for hip articular cartilage and labrum defects • MRI arthrography has high accuracy (90%) and diagnostic arthroscopy with labral resection
<p>2. Osteoarthritis (OA)</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Age ≥40 years • Hip pain only with possible protective limp • Activity-induced symptoms • Stiffness: in the morning or with periods of inactivity • May be bilateral • Significant decrease in pain with weight loss and exercise in patient >60 years <p>Test for range of motion (ROM):</p> <ul style="list-style-type: none"> • Restricted and painful internal rotation: (LOE III) • 3 Planes ROM limitations less sensitive but more specific 	<p>Radiographs indicated [B]</p> <p>AP spot and AP frog leg views</p>
<p>3. Inflammatory arthritis (seronegative and seropositive)</p> <p>Unrelenting morning stiffness >30 min, pain at rest, pain or stiffness better with</p>	<p>Radiographs indicated [D]</p> <p>AP spot and AP frog leg views</p> <p>AP pelvis may also be warranted as initial</p>

Patient Presentation	Recommendations
<p>light activity, polyarticular involvement, warmth, effusion, diffuse tenderness, decreased ROM; fever/chills or other systemic symptoms, responsive to nonsteroidal anti-inflammatory drug (NSAID)/steroid, flexion and adduction contracture in long-standing arthritis.</p> <p>Rheumatoid arthritis (RA) diagnostic criteria (≥ 4 of 7 required):</p> <ul style="list-style-type: none"> • Morning joint stiffness >1 hour • Arthritis involving ≥ 3 joints for at least 6 weeks • Hand arthritis (wrist, metacarpophalangeal joint [MCP], proximal interphalangeal joint [PIP]) • Symmetric arthritis • Rheumatoid nodules • Serum Rhesus (Rh) factor • Radiographic changes 	<p>study to assess both hips</p> <p>Special investigations [D]</p> <p>MRI highly sensitive and often more specific than US: detection of synovial pannus, erosions, cartilage loss, small subchondral cysts, and marrow edema distribution</p> <p>US may show effusion and osseous erosions</p>
<p>4. Osteonecrosis (avascular necrosis)</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Most common in those aged <50 years • Male:Female = 8:1; in younger patients, M:F = 4.2:1 • Progressive groin pain that may refer to the knee • Early stages: normal range of motion (ROM) • Advanced stages: limitation of extension, internal rotation and abduction; limping and atrophy 	<p>Radiographs indicated [B]</p> <p>AP spot and AP frog leg views</p> <p>Consider AP pelvis as initial examination as condition may be bilateral</p> <p>Special investigations [B]</p> <p>MRI useful when radiographs are normal, especially in high-risk patients; also NM and CT (when MRI unavailable)</p>
<p>5. Tumors and metastatic lesions</p> <p>Variable clinical features; spontaneous pathologic fracture is often first sign of metastasis from breast, lung, or prostate cancer.</p>	<p>Radiographs indicated [D]</p> <p>AP spot and AP frog leg views Special investigations [D]</p> <p>NM, CT, MRI</p>

Patient Presentation	Recommendations
6. Stress (fatigue or insufficiency) fractures Exertional anterior hip pain, especially after an increase in training regimen. Chronic repetitive overloads, typically in athletes or reduced mechanical bone properties (athletic amenorrhea, osteoporosis, corticosteroid use)	Radiographs indicated [D] AP spot and AP frog leg views If radiograph is inconclusive, re-radiograph after 10-14 days of restricted use before going to advanced imaging Special investigations [D] Bone scan, MRI, or CT in suspected occult, osteoporotic, or stress fractures
Adult patients with significant hip trauma Delay in recognition and reduction of acute dislocations, fractures, and fracture-dislocation of hip leads to preventable complications and morbidity (LOE III).	Radiographs indicated [C] AP pelvis, AP centered of hip, right and left obliques of the pelvis, and true lateral views Special investigations [C] MRI for patients with significant hip pain after injury, especially when unable to bear weight; also to exclude occult fracture and possible labral tear

Table 2: Adult Knee Disorders

Patient Presentation	Recommendations
Adult patients with nontraumatic knee pain of <4 weeks of duration <ul style="list-style-type: none"> Symptoms frequently arise from soft tissues not seen on radiographs Physical examination should include lower back, pelvis, hip, foot, and ankle as pain may be referred 	Radiographs not initially indicated [C]
General indications for knee radiographs include: <ul style="list-style-type: none"> History of noninvestigated trauma (with signs from the Ottawa knee rules (OKR)—see below) Complex history 	When radiographs are indicated or unless otherwise specified [D] <ul style="list-style-type: none"> Standing AP views for joint space

Patient Presentation	Recommendations
<ul style="list-style-type: none"> • Significant unexplained effusion with no previous films • Loss of mobility in undiagnosed condition • Acute/subacute onset • Intermittent locking • Unrelieved by 4 weeks of conservative care • Palpable enlarging mass 	<p>integrity</p> <ul style="list-style-type: none"> • Consider recumbent AP views if osseous detail is important • Lateral view • Tunnel (intercondylar) view <p>Special investigations [C]</p> <ul style="list-style-type: none"> • US useful to visualize superficial soft tissue structures (tendons, collateral ligament bursae) • MRI best for internal derangements and can often prevent unnecessary knee arthroscopy
Specific Clinical Diagnoses	
<p>1. Osteoarthritis (OA)</p> <p>The clinical criteria for OA of the knee are:</p> <p>History:</p> <ul style="list-style-type: none"> • Age > 50 years • Morning joint stiffness < 30 min <p>Physical examination:</p> <ul style="list-style-type: none"> • Crepitation • Bony tenderness • Bony enlargement • No palpable warmth <p>Other characteristics include: long-standing pain, no extra-articular symptoms; aggravated by weight bearing, climbing stairs, exercise; nonresponsive to nonsteroidal anti-inflammatory drugs (NSAID) or corticosteroid medication; relieved with rest; deformity or fixed contracture, joint effusion; insidious onset.</p>	<p>Radiographs indicated if unrelieved by 4 weeks of conservative care [B]</p> <p>AP, lateral, and intercondylar views if radiographs are indicated</p> <p>Additional views: 45° (oblique) views if signs and symptoms do not correlate with standard views</p> <p>Special investigations [B]</p> <p>US or MRI indicated if significant effusion and/or loss of joint space</p>
<p>2. Inflammatory arthritis (seronegative and</p>	<p>Radiographs indicated</p>

Patient Presentation	Recommendations
<p>seropositive)</p> <p>Diagnosis of inflammatory arthritis of the knee is primarily based on history and physical examination:</p> <ul style="list-style-type: none"> • Unrelenting morning stiffness \geq 30 min • Pain at rest • Pain or stiffness better with light activity (during remission) • Polyarticular involvement, especially the hands • Palpable warmth • Joint effusion • Decreased ROM • Fever/chills or other systemic symptoms • Responsive to NSAID or corticosteroid medication • Flexion and adduction contracture in long-standing arthritis <p>See also hip section for rheumatoid arthritis (RA) diagnostic criteria</p>	<p>[D]</p> <p>Consider bilateral AP standing views</p> <p>Special investigations [C]</p> <ul style="list-style-type: none"> • US and MRI may aid in staging and as indicator of disease progression • Knee aspiration if positive for effusion
<p>3. Bursitis/tendinitis/strain/tendinosis</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Related to or aggravated by activity • Relieved or diminished symptoms at rest • Point tenderness • Localized swelling (extra-articular) 	<p>Radiographs not routinely indicated unless [D]</p> <ul style="list-style-type: none"> • Unrelieved by 4 weeks of conservative care • Suspected avulsion fracture • Underlying arthropathy <p>Special investigations [D]</p> <ul style="list-style-type: none"> • MRI • Puncture of a popliteal cyst and corticosteroid injection can be done under US guidance
<p>4. Anterior knee pain</p> <p>Clinical features:</p>	<p>Radiographs indicated if [C]</p> <ul style="list-style-type: none"> • Unrelieved by 4

Patient Presentation	Recommendations
<ul style="list-style-type: none"> • Insidious onset • Aggravated with steps/incline/rising from chair • Stiffness with rest or gliding • Pseudolocking or giving way • Tender patellar facets • Positive apprehension tests • Crepitation • Abnormal Q angle <p>Clinical tests for the diagnosis of chondromalacia patella have low sensitivity, specificity, predictive values, and accuracy compared with tests for arthroscopy.</p>	<p>weeks of conservative care</p> <ul style="list-style-type: none"> • Suspected fracture • Underlying arthropathy <p>Additional views:</p> <ul style="list-style-type: none"> • Tangential patellar views to evaluate for chondromalacia, patellar tilt or subluxation • Stress radiographs to evaluate for patellofemoral instability (stress view: valgus and internal rotation at 45° of knee flexion) (Rindfleisch & Muller, 2005) <p>Special investigations [C]</p> <ul style="list-style-type: none"> • High-field MRI for chondromalacia and synovial plicae • Contrast CT arthrography if MRI unavailable
<p>5. Internal joint derangement</p> <p>Clinical features:</p> <p>History</p> <ul style="list-style-type: none"> • Acute or subacute onset • Mechanism of injury • Intermittent locking and/or giving way • Crepitation, snapping, and popping • Worse with activity • Improved with rest <p>(The accuracy of the clinical history in patients with suspected torn ligament or meniscus is unknown.)</p>	<p>Radiographs indicated if unrelieved by 4 weeks of conservative care [B]</p> <p>Standard AP, lateral views if necessary after 4 weeks</p> <p>Additional views: tunnel, standing lateral, standing oblique</p> <p>Special investigations [C]</p> <p>If diagnosis not well established from history, examination and</p>

Patient Presentation	Recommendations
<p>Physical examination:</p> <ul style="list-style-type: none"> • Joint line tenderness • Swelling and joint effusion • Loss of ROM <p>Meniscal tear: joint line tenderness, McMurray, and Ege's test (weight-bearing McMurray test)</p> <p>Ligamentous tear: Lachman maneuver, pivot test, and the Anterior Drawer Test</p>	<p>radiographs or in the absence of clinical improvement</p> <ul style="list-style-type: none"> • MRI is gold standard for internal knee derangements such as meniscal and ligamentous injuries • Spiral CT arthrography if MRI unavailable
<p>Adult with acute knee injury but negative findings for the (Ottawa knee rules) OKR indicates that a fracture is very unlikely.</p> <p>Consider radiographs only of patients excluded from the OKR:</p> <ul style="list-style-type: none"> • <18 years of age (YOA) • Pregnancy • Isolated skin injury • Referred with outside films • 7 days since injury • Multiple injuries • Altered level of consciousness • Paraplegic 	<p>Radiographs not routinely indicated [B]</p> <p>Patient should be advised to return for follow-up if their pain has not improved in 7 days</p>
<p>Adult with acute knee injury and positive findings for the OKR</p> <p>Radiographs indicated in the presence of one or more of the OKR criteria [A]</p> <p>Radiographs required only in the presence of postinjury knee pain and any one of the following findings:</p> <ul style="list-style-type: none"> • ≥55 YOA • Isolated tenderness at the head of the fibula or patella • Inability to flex knee $\geq 90^\circ$ • Inability to walk 4 weight-bearing steps both immediately and at presentation <p>Radiographs should also be obtained in the presence</p>	<p>AP supine and lateral views</p> <p>Additional views: bilateral obliques, tunnel, and tangential views</p> <p>Special investigations [C]</p> <ul style="list-style-type: none"> • Valgus stress radiographs under general anesthesia • MRI is the modality of choice for initial investigation of knee trauma. • CT, US, and angiogram may be needed for additional

Patient Presentation	Recommendations
of obvious deformity or mass.	information.

Table 3: Adult Ankle and Foot Disorders

Patient Presentation	Recommendations
<p>Adult with acute ankle and foot injury but negative findings on the Ottawa ankle and foot rules (OAR)</p> <p>Consider radiographs only of patients excluded from the OAR:</p> <ul style="list-style-type: none"> • Multiple injuries • Isolated skin injury • 10 days since injury • Obvious deformity of ankle or foot • Altered sensorium: cognitive or sensory impairment (neurologic deficit), head trauma, intoxicated 	<p>Radiographs not routinely indicated [B]</p>
<p>Adult with acute ankle and foot injury and positive findings on the Ottawa ankle and foot rules (OAR)</p> <p>a. Ankle (positive OAR)</p> <p>Radiographs required only if there is pain in the malleolar zone and any of these findings:</p> <ul style="list-style-type: none"> • Bone tenderness of distal fibula along posterior edge or tip of lateral malleolus (distal 6 cm) • Bone tenderness of distal tibia along posterior edge or tip of medial malleolus (distal 6 cm) • Inability to bear weight both immediately and in clinic <p>Also consider taking ankle radiographs in:</p> <ul style="list-style-type: none"> • Older patients with malleolar 	<p>Ankle radiographs indicated [B] AP ankle, 20° medial oblique (mortise views) and lateral (include base of fifth metatarsal)</p> <p>Additional views [D]: Stress radiographs after fibular fracture helpful pre-operatively to determine deltoid ligament status in orthopedic setting.</p> <p>Special investigations [D]</p> <ul style="list-style-type: none"> • MRI or CT appropriate in presence of significant pain and disability and negative radiographs • Fluoroscopic stress examination under anesthesia to assess ankle instability • NM for persisting symptoms to

Patient Presentation	Recommendations
<p>tenderness and pronounced soft tissue edema</p> <ul style="list-style-type: none"> • Presence of positive OAR foot findings 	<p>exclude stress fracture</p>
<p>b. Foot (positive OAR)</p> <p>Radiograph required only if there is pain in the midfoot zone and any of these findings:</p> <ul style="list-style-type: none"> • Bone tenderness of base of fifth metatarsal • Bone tenderness of navicular bone • Unable to bear weight both immediately and in clinic 	<p>Foot radiographs indicated [B]</p> <p>When feasible, weight-bearing foot AP, lateral, medial oblique views</p> <p>Comparison views (normal foot) may be helpful.</p> <p>Additional view: Tangential view of calcaneus for heel trauma cases</p>
<p>Adult with acute toe injury</p> <p>Consider obtaining foot radiographs in presence of significant metatarsal pain (see OAR-Foot)</p>	<p>Radiographs indicated (GPP): AP, oblique, and lateral views limited to the toes</p>
<p>Adult with chronic ankle and tarsal pain</p> <p>Specific indications for radiographs include:</p> <ul style="list-style-type: none"> • Suspected osteochondral lesion/stress fracture • Suspected tendinopathy with possible inflammatory arthritis • Possible ankle instability. Single-leg jump test as clinical indicator of functional instability • Noninvestigated chronic ankle and tarsal pain • Multiple sites of degenerative joint disease as visualized on radiographs • Possible operative candidate 	<p>Radiographs indicated [D]</p> <p>AP ankle, lateral, medial oblique (mortise) views</p> <p>(Medial oblique view helps evaluate the talocalcaneal relationship and lateral malleolus.)</p> <p>Additional view: Stress radiographs may be considered, but little agreement exists as to which technique.</p> <p>Special investigations [D]</p> <p>MRI is the gold standard for musculoskeletal assessment if radiography is positive or if unrelieved by 4 weeks of conservative care.</p> <ul style="list-style-type: none"> • Contrast-enhanced, fat-suppressed, 3D, fast-gradient MRI may be useful in diagnosing

Patient Presentation	Recommendations
	synovitis and soft tissue impingement.
Specific Clinical Diagnoses	
1. Impingement syndromes Findings most strongly associated with abnormality at arthroscopy: <ul style="list-style-type: none"> • Anterolateral tenderness • Swelling • Pain on single-leg squatting • Pain on ankle dorsiflexion and eversion 	Radiographs indicated [D] AP ankle, lateral and mortise views Special investigations [D] For all suspected impingement syndromes with positive radiographs or unrelieved by 4 weeks of conservative care: <ul style="list-style-type: none"> • Contrast-enhanced, fat-suppressed, 3D, fast-gradient MRI may be indicated depending on pain severity and disability.
a. Anterolateral impingement Clinical features: <ul style="list-style-type: none"> • Mechanism: inversion injury • Pain and localized tenderness in region of anteroinferior tibiofibular and/or anterior talofibular ligament • Positive impingement sign 	Radiographs indicated [D] AP, lateral, and mortise ankle views Additional view: [D] Stress radiographs may be considered.
b. Anterior impingement Clinical features: <ul style="list-style-type: none"> • Mechanism: supination or repeated dorsiflexion injury • Anterior pain • Painful and restricted dorsiflexion 	Radiographs indicated [D] AP, lateral, and mortise ankle views
c. Anteromedial impingement Clinical features:	Radiographs indicated [D] AP, lateral, and mortise ankle views

Patient Presentation	Recommendations
<ul style="list-style-type: none"> • Mechanism: inversion injury or ankle/talar fracture • Anteromedial pain and tenderness • Swelling • Pain and restriction on dorsiflexion and supination 	
<p>d. Posterior impingement</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Mechanism: impingement of os trigonum between talus and posterior tibia • Common in ballet dancers • Pain elicited with full weight-bearing in maximum plantar flexion, especially when os trigonum is present • Tenderness behind lateral malleolus 	<p>Radiographs indicated [D]</p> <p>AP, lateral, and mortise ankle views</p> <p>Special investigations [D]</p> <p>MRI for os trigonum syndrome</p> <ul style="list-style-type: none"> • Pain with passive plantar flexion
<p>2. Peroneal tendinosis</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Lateral hindfoot pain • Cavovalgus foot deformity • Frequently affected in RA 	<p>Radiographs not routinely indicated [D]</p> <p>Unless unrelieved by 4 wk of conservative care or patient has a suspected inflammatory arthritis</p> <p>Special investigations [D]</p> <ul style="list-style-type: none"> • MRI or US if there are signs of popping or clicking with foot eversion
<p>3. Lateral premalleolar bursitis</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Adventitious bursa develops in people sitting with inverted and plantar flexed feet 	<p>Radiographs not routinely indicated [GPP]</p> <p>Special investigations [GPP]</p> <p>US if unrelieved by 4 weeks of conservative care</p>
<p>4. Tarsal tunnel syndrome</p>	<p>Radiographs not routinely indicated [D]</p>

Patient Presentation	Recommendations
<p>Clinical features:</p> <ul style="list-style-type: none"> • Tingling pain and burning over the sole of the foot after prolonged standing or walking • Worse at night in some • Positive Tinel sign • Positive nerve compression test • 2-Point discrimination • Hypoesthesia on sole of foot • Rare weakness of toe flexion 	<p>Special investigations [D]</p> <ul style="list-style-type: none"> • US or MRI for nerve and other soft tissue visualization • CT for bony abnormalities • Sensory conduction velocity and distal motor latency useful for diagnosis and treatment progression
<p>Adult with chronic foot pain</p>	<p>Radiographs generally indicated [C]</p> <p>Non-weight-bearing AP, lateral, medial, and lateral oblique views</p> <p>Additional views:</p> <ul style="list-style-type: none"> • Lateral views for toes • Axial and lateromedial tangential views for sesamoid bones <p>Special investigations [D]</p> <ul style="list-style-type: none"> • NM, MRI, US, arthrography may be useful • Laboratory investigations (blood and synovial fluid) recommended
<p>A. Hindfoot-Heel pain</p>	<p>Radiographs indicated [D]</p> <p>AP, lateral, and medial oblique views of the foot</p> <p>Additional views:</p> <p>Tangential view of the calcaneus and lateral calcaneus view</p> <p>Special investigations [D]</p> <ul style="list-style-type: none"> • MRI if unrelieved by 4 weeks of conservative care or before

Patient Presentation	Recommendations
	<p>referral for medical care or to podiatrist</p> <ul style="list-style-type: none"> Achilles enthesopathy: power Doppler sonography may show neovascularization, which may be the cause of pain
Specific Clinical Diagnoses	
<p>A1. Plantar fasciitis (PF) and calcaneal enthesophyte (spur)</p> <p>Clinical features:</p> <ul style="list-style-type: none"> PF is one of the most common soft tissue foot disorders Hyperesthesia over the plantar fascia Risk factors: <ul style="list-style-type: none"> Decreased ankle dorsiflexion ($\leq 0^\circ$) Being on their feet most of working day Obesity (body mass index $>30 \text{ kg/m}^2$) 	<p>Radiographs not routinely indicated except in young athlete [B]</p> <p>AP, lateral, and oblique views</p> <p>Special investigations [D]</p> <ul style="list-style-type: none"> US may be initial step for advanced imaging (readily available, highly sensitive, low-cost, and radiation-free). Doppler/power US improves US value US, MRI, and bone scan are more sensitive in showing inflammatory changes and thickening of the plantar aponeurosis in PF
<p>A2. Sinus tarsi syndrome</p> <p>Clinical features:</p> <ul style="list-style-type: none"> Mechanism: inversion injury or inflammatory joint diseases Lateral foot pain Perceived foot instability Tenderness of the sinus tarsi 	<p>Radiographs not initially indicated [D]</p> <p>Special investigations [D]</p> <p>MRI if unrelieved by 4 weeks of conservative care: may be helpful for detecting subtle unilateral deformities</p>
<p>B. Midfoot pain (nontraumatic)</p> <p>Midfoot pain usually self-limiting.</p> <p>Differential diagnosis:</p> <ul style="list-style-type: none"> RA 	<p>Radiographs indicated if unrelieved by 4 weeks of conservative care or in suspected inflammatory arthritis [D] AP, medial oblique, and lateral views of the foot</p> <p>Additional views: Weight-bearing</p>

Patient Presentation	Recommendations
<ul style="list-style-type: none"> • Psoriatic arthritis • Reactive arthritis (Reiter disease) • Diabetic neuroarthropathy/Charcot joints • Gout • Diabetic infection 	<p>ankle series may be useful</p> <p>Special investigations if radiography is positive or if unrelieved by 4 weeks of conservative care [GPP]</p> <p>CT or MRI warranted in suspected or proven disease, but negative/equivocal radiographs</p>
Specific Clinical Diagnoses	
<p>B1. Acquired flat foot with posterior tibial tendon dysfunction/rupture</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Medial ankle/foot pain initially • May lead to disabling weight bearing symptoms • Talonavicular subluxation • Difficulty or inability to perform single-limb heel rise • Weak resisted inversion of fully flexed foot 	<p>Radiographs indicated if unrelieved by 4 weeks of conservative care or in suspected inflammatory arthritis [D]</p> <p>AP, medial oblique, and lateral foot radiographs</p> <p>Additional views: Weight-bearing ankle series may be useful</p> <p>Special investigations [D]</p> <ul style="list-style-type: none"> • MRI better at differential diagnosis of medial ankle/foot pain • US may be useful
<p>B2. Navicular tuberosity pain and tenderness (Auleley et al, 1998)</p> <p>Potential painful normal variants such as accessory navicular bone (4%-21% of the population) have been described.</p> <p>Painful fibro-osseous junction of the accessory bone</p>	<p>Radiographs indicated if unrelieved by 4 weeks of conservative care [C]</p> <p>AP, medial oblique, and lateral foot views</p> <p>Special investigations [GPP]</p> <ul style="list-style-type: none"> • MRI to differentiate accessory navicular from an avulsion fracture • NM may be useful to help identify or confirm site of pain
<p>B3. Complex regional pain syndrome</p>	<p>Radiographs indicated [D]</p>

Patient Presentation	Recommendations
<p>Synonyms:</p> <ul style="list-style-type: none"> • Reflex sympathetic dystrophy • Sudek's atrophy <p>Clinical features:</p> <ul style="list-style-type: none"> • Pain • Tenderness • Swelling • Diminished motor function • Vasomotor and sudomotor instability 	<p>AP, lateral, and medial oblique views of the foot</p> <p>Special investigations [D]</p> <ul style="list-style-type: none"> • MRI is useful in detecting numerous soft tissue and earlier bone and joint processes that are not depicted or as well characterized with other imaging modalities • 3-Phase NM scan recommended if radiograph is not diagnostic
<p>C. Forefoot pain</p> <p>See recommendations for the following specific clinical diagnoses:</p> <p>C1. Metatarsal bursitis C2. Morton neuroma C3. Stress fracture C4. Avascular necrosis (osteonecrosis) C5. Hallux rigidus and hallux valgus C6. Sesamoiditis</p>	<p>Radiographs not routinely indicated unless unresponsive to 4 weeks of conservative care or if inflammatory or infectious etiology suspected [B]</p> <p>AP and lateral foot views</p> <p>Special investigations [D]</p> <p>MRI useful in differential diagnosis of forefoot pain such as stress fracture, metatarsophalangeal synovitis, and intermetatarsal bursitis</p>
<p>C1. Metatarsal bursitis</p>	<p>Radiographs not routinely indicated unless unresponsive to 4 weeks of conservative care, or if inflammatory or infectious etiology suspected [GPP]</p> <p>AP and lateral foot views</p> <p>Special investigations [GPP]</p> <p>MRI useful in differential diagnosis of forefoot pain</p>
<p>C2. Morton neuroma</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Most commonly found in the 3-4 	<p>Radiographs indicated [C]</p> <p>AP, lateral, with or without oblique</p> <p>Special investigations [D]</p>

Patient Presentation	Recommendations
<p>web space</p> <ul style="list-style-type: none"> • Pain hyperesthesia or paresthesia radiation to the toes • Differential diagnosis from metatarsophalangeal joint (MTP) arthritis may be difficult • Positive forefoot neuroma squeeze test 	<p>MRI</p>
<p>C3. Stress (fatigue or insufficiency) fracture</p> <p>Clinical features:</p> <p>Pain and tenderness present in the:</p> <ul style="list-style-type: none"> • Second and third metatarsal • Calcaneus • First metatarsal • Medial sesamoid • Navicular 	<p>Radiographs indicated [D]</p> <p>AP and lateral foot views with or without medial oblique specific to the area of complaint</p> <p>Special investigations [C]</p> <ul style="list-style-type: none"> • High-field MRI with fat suppression or inversion recovery protocol. As sensitive as NM • CT still uncertain; some centers use US
<p>C4. Osteonecrosis of metatarsal head (Freiberg infraction)</p> <p>Clinical features:</p> <ul style="list-style-type: none"> • Adolescent patient • Pain • Tenderness • Swelling • Limitation of movement at metatarsal head • Second or third head most commonly affected 	<p>Radiographs indicated [C]</p> <p>AP, lateral, with or without medial oblique of the foot</p> <p>Special investigations [C]</p> <ul style="list-style-type: none"> • MRI modality of choice to evaluate bone marrow changes in early stages
<p>C5. Hallux rigidus and hallux valgus (first metatarsophalangeal [MTP] joint)</p>	<p>Radiographs not routinely indicated unless unresponsive to 4 weeks of conservative care [D]</p> <p>Lateral view most useful for dorsal osteophyte on the metatarsal head and possible osseous fragments</p>

Patient Presentation	Recommendations
	Additional view: Weight-bearing series to quantify degree of valgus deformity
C6. Sesamoiditis Painful inflammatory condition caused by repetitive injury; reactive tendinitis, synovitis, or bursitis common	Radiographs not routinely indicated unless unresponsive to 4 weeks of conservative care [D] Additional view: Lateromedial tangential views for sesamoid bones Special investigations [GPP] <ul style="list-style-type: none"> MRI to differentiate from turf toe

Definitions:

Levels of Evidence

Classification based on Stroke Prevention and Educational Awareness Diffusion (SPREAD) validated methodological criteria.

1++: High-quality meta-analyses without heterogeneity, systematic reviews of randomized controlled trials (RCTs) each with small confidence intervals CI), or RCTs with very small CI and/or very small alpha and beta

1+: Well-conducted meta-analyses without clinically relevant heterogeneity, systematic reviews of RCTs, or RCTs with small CI and/or small alpha and beta

1–: Meta-analyses with clinically relevant heterogeneity, systematic reviews of RCTs with large CI, or RCTs with large CI and/or alpha or beta

2++: High-quality systematic reviews of case-control or cohort studies. High-quality case-control or cohort studies with very small CI and/or very small alpha and beta

2+: Well-conducted case-control or cohort studies with small CI and/or small alpha and beta

2–: Case-control or cohort studies with large CI and/or large alpha or beta

3: Nonanalytic studies, (e.g., case reports, case series)

4: Expert opinion

– **(minus)**: Meta-analyses with clinically relevant heterogeneity; systematic reviews of trials with large confidence intervals; trials with large CIs, and/or large alpha and/or beta

Grades of Recommendation

This tool has been developed to grade recommendations according to the strength of available scientific evidence (level A to D)

A: At least one meta-analysis, systematic review or RCT rated as 1++, and directly applicable to the target population; or a systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results

B: A body of evidence including studies rated as 2++, directly applicable to the target population and demonstrating overall consistency of results; or extrapolated evidence from studies rated as 1++ or 1+

C: A body of evidence including studies rated as 2+, directly applicable to the target population And demonstrating overall consistency of results; or extrapolated evidence from studies rated as 2+**

D: Evidence level 3 or 4; or extrapolated evidence from studies rated as 2+; or evidences from trials classified as (minus) regardless of the level

Good practice point: Recommended best practice based on the clinical experience of the guideline development group, without research evidence.

This tool aims to evaluate the scientific evidence according to prespecified levels of certainty (1++ to 4). In this study, Good Practice Point also represents consensus of the Delphi panel. CI indicates confidence intervals

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

REFERENCES SUPPORTING THE RECOMMENDATIONS

[References open in a new window](#)

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is identified and graded for each recommendation (see "Major Recommendations").

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Appropriate radiologic imaging procedures for evaluation of patients with musculoskeletal disorders of the lower extremities
- Decreased unnecessary ionizing radiation exposure
- Decreased costs
- Improved accessibility

POTENTIAL HARMS

Although somewhat controversial, it is important to remember that health hazards of all forms of radiation are cumulative. The Biological Effects of Ionizing Radiation (BEIR VII) 2005 report released by the National Academy of Sciences adds further support to the "linear-no-threshold" model of cancer risk from ionizing radiation exposure. In summary, this report concludes that ionizing radiation is dangerous even at low doses and that there are no safe limits. Given the potential risks associated with conventional radiography, only appropriate clinical indications can justify its use.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- These guidelines are intended to address issues faced by first-contact professionals only. These guidelines do not address all possible conditions associated with musculoskeletal disorders, only those that account for most initial visits to a practitioner.
- Like other diagnostic tests, imaging studies should only be considered if (a) they yield clinically important information beyond that obtained from the history and physical examination, (b) this information can potentially alter patient management, and (c) this altered management has a reasonable probability to improve patient outcomes.
- Investigators and collaborators in the development of these imaging guidelines believe that liability insurance companies, third-party payers, and courts of law should not rely solely on descriptions of patient presentations, proposed recommendations, and/or corresponding comments found throughout the documents because patient presentations are unique and the application of any guideline always requires clinical judgment and thus needs to be considered in the proper context. In addition, laws and regulations may vary between geographical regions and should be considered when applying the proposed indications for any imaging study.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

Means of dissemination include publication; application to the National Guideline Clearinghouse; posting of the electronic document on various Web sites

(malpractice insurance carriers, outpatient teaching clinics); educational intervention strategies (e-learning, community pilot studies); referral guidelines, reinforced by request checking and clinical management algorithms; promotion by national, provincial, and state organizations; and conferences.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better
Living with Illness

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Bussieres AE, Taylor JA, Peterson C. Diagnostic imaging practice guidelines for musculoskeletal complaints in adults--an evidence-based approach. Part 1. Lower extremity disorders. J Manipulative Physiol Ther 2007 Nov-Dec;30(9):684-717. [212 references] [PubMed](#)

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2007 Dec

GUIDELINE DEVELOPER(S)

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l'Université du Québec à Trois-Rivières - Academic Institution

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l'Université du Québec à Trois-Rivières
Canadian Protective Chiropractic Association

GUIDELINE COMMITTEE

Not stated

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

The research team involved in the development of these guidelines declares no existing or potential conflict of interest. No investigators have received, nor will receive, any personal financial benefits or derive any salary from this project.

GUIDELINE STATUS

This is the current release of the guideline.

The literature review and the guidelines should be updated every 3 years.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the [*Journal of Manipulative and Physiological Therapeutics*](#).

Print copies: Available from Bussi res, Andr , department chiropratique, Universit  du Qu bec   Trois-Rivi res, C.P. 500, Trois-Rivi res, Qu bec, Canada G9A 5H7; E-mail: andre.bussieres@uqtr.ca.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- Diagnostic imaging practice guidelines for musculoskeletal complaints in adults - an evidence-based approach: introduction. *J Manipulative Physiol Ther* 2007 Nov-Dec;30(9):617-683.

Electronic copies: Available in Portable Document Format (PDF) from the [*Journal of Manipulative and Physiological Therapeutics*](#).

Print copies: Available from Bussi res, Andr , department chiropratique, Universit  du Qu bec   Trois-Rivi res, C.P. 500, Trois-Rivi res, Qu bec, Canada G9A 5H7; E-mail: andre.bussieres@uqtr.ca.

PATIENT RESOURCES

None available

NGC STATUS

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